PB-240 516

MASHKENODE LAKE, ST. LOUIS COUNTY, MINNESOTA

Pacific Northwest Environmental Research Laboratory

Prepared for:

National Environmental Research Center
Minnesota Pollution Control Agency
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U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

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16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 05C

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I

REPORT
ON
MASHKENODE LAKE
ST. LOUIS COUNTY
MINNESOTA
EPA REGION V
WORKING PAPER No. 111

WITH THE COOPERATION OF THE
MINNESOTA POLLUTION CONTROL AGENCY
AND THE
MINNESOTA NATIONAL GUARD
DECEMBER, 1974

II

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Minnesota Pollution Control Agency for professional involvement and to the Minnesota National Guard for conducting the tributary sampling phase of the Survey.

Grant J. Merritt, Director of the Minnesota Pollution Control Agency, John F. McGuire, Chief, and Joel G. Schilling, Biologist, of the Section of Surface and Groundwater, Division of Water Quality, provided invaluable lake documentation and counsel during the course of the Survey; and the staff of the Section of Municipal Works, Division of Water Quality, were most helpful in identifying point sources and soliciting municipal participation in the Survey.

Major General Chester J. Moeglein, the Adjutant General of Minnesota, and Project Officer Major Adrian Beltrand, who directed the volunteer efforts of the Minnesota National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

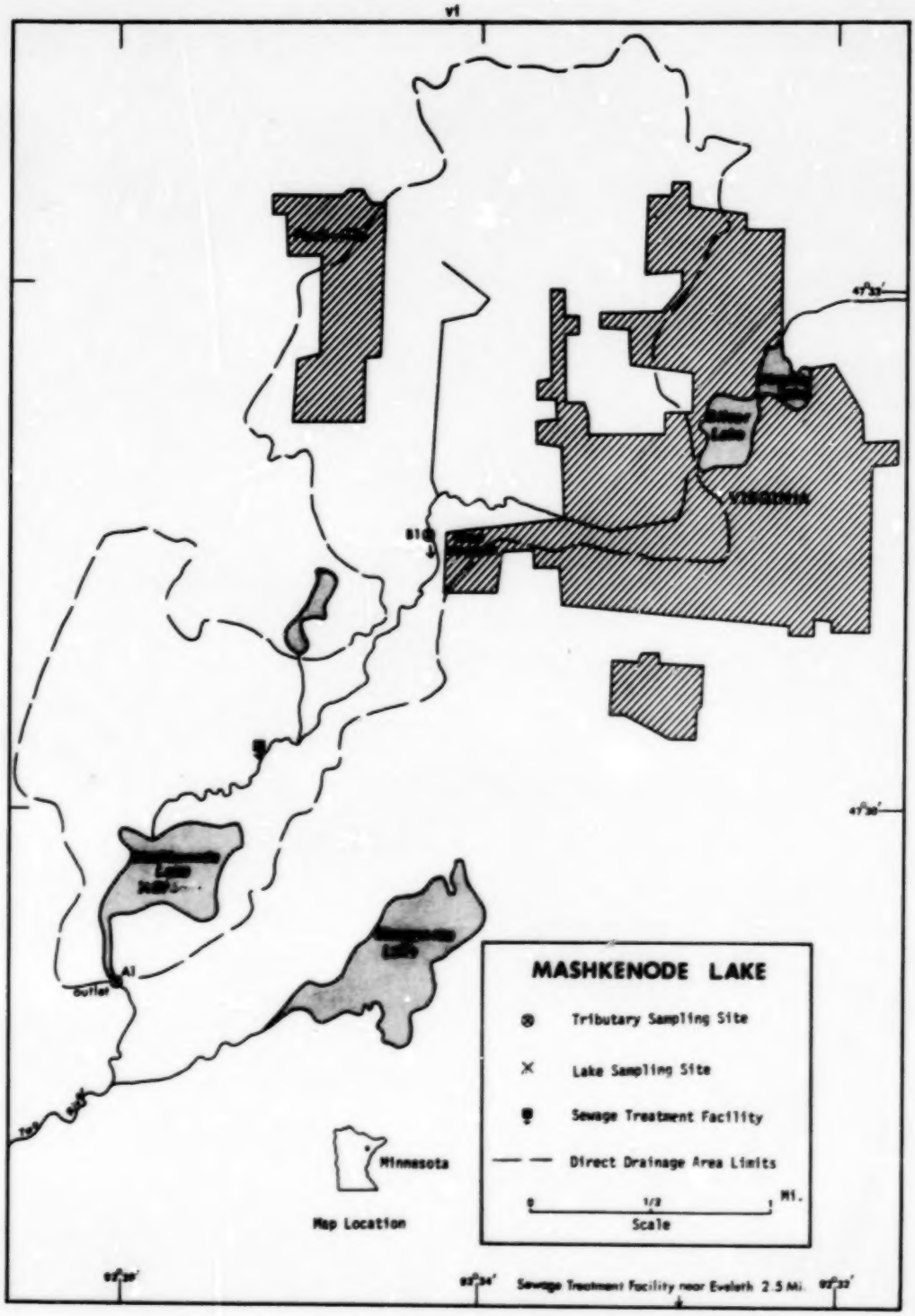
NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF MINNESOTA

LAKE NAME	COUNTY
Albert Lea	Freeborn
Andrusia	Beltrami
Badger	Polk
Bartlett	Koochiching
Bear	Freeborn
Bemidji	Beltrami
Big	Stearns
Big Stone	Big Stone, MN; Roberts, Grant, SD
Birch	Cass
Blackduck	Beltrami
Blackhoof	Crow Wing
Budd	Martin
Buffalo	Wright
Calhoun	Hennepin
Carlos	Douglas
Carrigan	Wright
Cass	Beltrami, Cass
Clearwater	Wright, Stearns
Cokato	Wright
Cranberry	Crow Wing
Darling	Douglas
Elbow	St. Louis
Embarass	St. Louis
Fall	Lake
Forest	Washington
Green	Kandiyohi
Gull	Cass
Heron	Jackson
Leech	Cass
Le Homme Dieu	Douglas
Lily	Blue Earth
Little	Grant
Lost	St. Louis

LAKE NAME	COUNTY
Madison	Blue Earth
Malmedal	Pope
Mashkenode	St. Louis
McQuade	St. Louis
Minnetonka	Hennepin
Minnewaska	Pope
Mud	Itasca
Nest	Kandiyohi
Pelican	St. Louis
Pepin	Goodhue, Wabasha, MN; Pierce, Pepin, WI
Rabbit	Crow Wing
Sakatah	Le Sueur
Shagawa	St. Louis
Silver	McLeod
Six Mile	St. Louis
Spring	Washington, Dakota
St. Croix	Washington, MN; St. Croix, Pierce, WI
St. Louis Bay	St. Louis, MN; Douglas, WI
Superior Bay	St. Louis, MN; Douglas, WI
Swan	Itasca
Trace	Todd
Trout	Itasca
Wagonga	Kandiyohi
Wallmark	Chisago
White Bear	Washington
Winona	Douglas
Wolf	Beltrami, Hubbard
Woodcock	Kandiyohi
Zumbro	Olmstead, Wabasha


MASHKENODE LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Direct Drainage Area Limits
0
1/2
1 Mi.
Scale
Minnesota
Map Location
Sewage Treatment Facility near Evelath 2.5 Mi.

MASHKENODE LAKE

STORET NO. 2756

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Mashkenode Lake is eutrophic. Of the 60 Minnesota lakes surveyed in the fall of 1972, when essentially all were well-mixed, 30 had less mean total phosphorus, 15 had less mean dissolved phosphorus, and 11 had less mean inorganic nitrogen. Of the 80 Minnesota lakes sampled, 43 had greater Secchi disc transparency, and 49 had less mean chlorophyll a.

Survey limnologists noted that water quality was generally poor on all visits. High turbidity, anaerobic conditions with hydrogen sulfide evident, and intensive algal blooms and large areas of floating macrophytes were observed.

B. Rate-Limiting Nutrient:

The results of the algal assay show that nitrogen was the limiting nutrient at the time the sample was collected. The lake data also indicate that nitrogen was limiting at the other sampling periods (N/P ratios were less than 8/1 on all occasions).

C. Nutrient Controllability:

1. Point sources--During the sampling year, Mashkenode Lake received a total phosphorus load at a rate more than six times

that proposed by Vollenweider (in press) as "dangerous"; i.e., a eutrophic rate (see page 13). Of that load, it is estimated the Nichols Township wastewater treatment plant contributed nearly 88%.

It is calculated that complete removal of phosphorus at the point source would reduce the loading rate to 5.8 lbs/acre/yr or 0.65 $g/m^2/yr$ (a mesotrophic rate). If 100% removal can be accomplished, the trophic condition of Mashkenode Lake should improve.

2. Non-point sources (see page 13)--The phosphorus export of the unnamed stream (B-1) compares well with the mean phosphorus export of five unimpacted tributaries of nearby Swan Lake* (28 $lbs/mi^2/yr$).

In all, it is estimated that non-point sources contributed about 12% of the total phosphorus load to the lake during the sampling year.

* Working Paper No. 129.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 101 acres.
2. Mean depth: 7 feet.
3. Maximum depth: 14 feet.
4. Volume: 707 acre/feet.
5. Mean hydraulic retention time: 40 days.

B. Tributary and Outlet:
(See Appendix A for flow data)

1. Tributaries -

Name	Drainage area*	Mean flow*
Unnamed stream (B-1)	16.7 mi^2	8.6 cfs
Minor tributaries & immediate drainage -	0.7 mi^2	0.4 cfs
Totals	17.4 mi^2	9.0 cfs

2. Outlet -

Two Rivers	17.6 mi^2**	9.0 cfs**

C. Precipitation***:

1. Year of sampling: 29.8 inches.
2. Mean annual: 26.9 inches.

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† DNR lake survey map (1964).
* Drainage areas are accurate within ±5%; mean daily flows are accurate within ±10%; and ungaged flows are accurate within ±10 to 25% for drainage areas greater than 10 mi^2.
** Includes area of lake; outflow adjusted to equal sum of inflow.
*** See Working Paper No. 1, "Survey Methods".

III. LAKE WATER QUALITY SUMMARY

Mashkenode Lake was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two or more depths at one station on the lake (see map, page vi). During each visit, a single depth-integrated (near bottom to surface) sample was collected for phytoplankton identification and enumeration; and during the last visit, a single five-gallon depth-integrated sample was collected for algal assays. Also, each time a depth-integrated sample was collected for chlorophyll a analysis. The maximum depth sampled was 12 feet.

The results obtained are presented in full in Appendix B, and the data for the fall sampling period, when the lake was essentially well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix B.

A. Physical and chemical characteristics:

Parameter	Minimum	FALL VALUES (10/19/72) Mean	Median	Maximum
Temperature (Cent.)	3.8	3.8	3.8	3.8
Dissolved oxygen (mg/l)	12.0	12.0	12.0	12.0
Conductivity (µmhos)	300	300	300	300
pH (units)	8.7	8.7	8.7	8.7
Alkalinity (mg/l)	87	89	88	92
Total P (mg/l)	0.050	0.053	0.052	0.058
Dissolved P (mg/l)	0.016	0.018	0.019	0.019
NO_2 + NO_3 (mg/l)	0.040	0.040	0.040	0.040
Ammonia (mg/l)	0.070	0.077	0.080	0.080
		ALL VALUES		
Secchi disc (inches)	36	41	42	46

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Number per ml
07/10/72	1. Cyclotella	904
	2. Oocystis	832
	3. Asterionella	687
	4. Fragilaria	452
	5. Flagellates	307
	Other genera	1,321
	Total	4,503
09/09/72	1. Microcystis	6,396
	2. Aphanocapsa	5,766
	3. Peridinium	2,432
	4. Dictyosphaerium	1,261
	5. Anabaena	811
	Other genera	4,054
	Total	19,459
10/19/72	1. Cyclotella	15,639
	2. Flagellates	2,632
	3. Fragilaria	2,030
	4. Cylindrocystis	1,654
	5. Anabaena	827
	Other genera	4,286
	Total	27,068

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
07/10/72	01	24.3
09/09/72	01	13.7
10/19/72	01	37.9

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.017	0.100	2.6
0.005 P	0.022	0.100	2.7
0.010 P	0.027	0.100	2.4
0.020 P	0.037	0.100	2.4
0.050 P	0.067	0.100	2.4
0.050 P + 10.0 N	0.067	10.100	32.2
10.0 N	0.017	10.100	9.2

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that Mashkenode Lake had a moderately high rate of primary productivity at the time the assay sample was collected.

The lack of change in yield when phosphorus spikes were increased and the significant increase in yield when only nitrogen was added show nitrogen limitation.

The lake data at each of the three sampling times indicate nitrogen limitation; i.e., the N/P ratios were less than 8/1, and nitrogen limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix C for data)

For the determination of nutrient loadings, the Minnesota National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page vi), except for the high runoff months of May and August when two samples were collected. Sampling was begun in October, 1972, and was completed in September, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Minnesota District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated by using the means of the nutrient loads, in lbs/mi^2/year, in nearby Swan Lake tributaries at stations B-1, C-1, G-1, H-1, and J-1 and multiplying the means by the ZZ area in mi^2.

Nichols Township did not participate in the Survey and nutrient loads were estimated at 2.5 lbs P and 7.5 lbs N/capita/year.

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* See Working Paper No. 1.

A. Waste Sources:

1. Known municipal† -

Name	Pop. Served	Treatment	Mean Flow (mgd)	Receiving Water
Nichols Township	1,702*	stab. pond	0.170**	Creek to Mashkenode Lake

2. Known industrial - None

† Anonymous, 1974.
* 1970 Census.
** Estimated at 100 gal/capita/day.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/yr	% of total
a. Tributaries (non-point load) -		
Unnamed Creek (B-1)	550	11.4
b. Minor tributaries & immediate drainage (non-point load) -	20	0.4
c. Known municipal -		
Nichols Township	4,260	87.8
d. Septic tanks - None	-	-
e. Known industrial - None	-	-
f. Direct precipitation* -	20	0.4
Total	4,850	100.0

2. Outputs -

Lake outlet - Two Rivers 1,250

3. Net annual P accumulation - 3,600 pounds

* See Working Paper No. 1.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed Creek (B-1)	20,950	60.5
b. Minor tributaries & immediate drainage (non-point load) -	820	2.4
c. Known municipal -		
Nichols Township	12,760	36.9
d. Septic tanks - None	-	-
e. Known industrial - None	-	-
f. Direct precipitation* -	970	0.2
Total	35,500	100.0

2. Outputs -

Lake outlet - Two Rivers 15,580

3. Net annual N accumulation - 19,920 pounds

* See Working Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs $P/mi^2/yr$	lbs $N/mi^2/yr$
Unnamed Creek (B-1)	33	1,254

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving waters would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

	Total Phosphorus		Total Nitrogen	
Units	Total	Accumulated	Total	Accumulated
lbs/acre/yr	48.0	35.6	351.5	197.2
grams/m^2/yr	5.38	4.00	39.4	22.1

Vollenweider loading rates for phosphorus ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Mashkenode Lake:

"Dangerous" (eutrophic rate)	0.84
"Permissible" (oligotrophic rate)	0.42

V. LITERATURE REVIEWED

Anonymous, 1974. Wastewater disposal facilities inventory. MPCA, Minneapolis.

Vollenweider, Richard A., (in press). Input-output models. Schweiz A. Hydrol.

VII. APPENDICES

APPENDIX A

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR MINNESOTA 10/30/74

LAKE CODE 2756 MASHKENODE LAKE

TOTAL DRAINAGE AREA OF LAKE 17.60

TRIBUTARY	SUB-DRAINAGE AREA	NORMALIZED FLOWS JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
2756A1	17.60	0.61	0.65	2.12	45.40	22.20	11.60	9.20	2.95	3.42	6.11	4.02	1.07	9.11
2756B1	16.70	0.61	0.64	2.09	42.80	21.00	11.00	8.74	2.80	3.26	5.80	3.81	1.04	8.63
2756ZZ	0.90	0.02	0.01	0.07	1.93	1.02	0.61	0.42	0.11	0.16	0.21	0.14	0.04	0.48

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 17.60
SUM OF SUB-DRAINAGE AREAS = 17.60

TOTAL FLOW IN = 108.35
TOTAL FLOW OUT = 109.35

MEAN MONTHLY FLOWS AND DAILY FLOWS

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2756A1	10	72	3.81	15	3.80				
	11	72	2.91	12	2.60				
	12	72	0.70						
	1	73	0.49	9	0.50				
	2	73	0.66						
	3	73	4.54	9	0.90				
	4	73	9.99	18	8.90				
	5	73	16.90	2	11.00	19	8.10		
	6	73	8.24	7	4.60				
	7	73	4.05						
	8	73	5.66	19	12.60	25	4.50		
	9	73	2.01	23	1.40				
2756B1	10	72	3.61	15	3.60				
	11	72	1.91	12	2.40				
	12	72	0.68						
	1	73	0.49	9	0.50				
	2	73	0.65						
	3	73	4.47	9	0.90				
	4	73	9.42	18	8.40				
	5	73	16.00	2	11.00	19	7.70		
	6	73	7.81	7	4.40				
	7	73	3.85						
	8	73	5.38	19	8.60	25	4.30		
	9	73	1.92	23	1.30				
2756ZZ	10	72	0.15	15	0.20				
	11	72	0.07	12	0.09				
	12	72	0.02						
	1	73	0.02	9	0.02				
	2	73	0.91						
	3	73	0.15	9	0.03				
	4	73	0.42	18	0.40				
	5	73	0.74	2	0.50	19	0.40		
	6	73	0.43	7	0.20				
	7	73	0.18						
	8	73	0.21	19	0.47	25	0.17		
	9	73	0.11	23	0.07				

APPENDIX B

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 74/10/30

275601
47 49 42.0 092 35 52.0
MASHKENODE LAKE
27 MINNESOTA

11EPALES
3

2111202
0015 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/07/10	18 30	0000			46	270	9.30	102	0.110	0.080	0.074	0.023
	18 30	0004	22.0	11.2		300	9.20	99	0.090	0.070	0.076	0.022
	18 30	0012	17.9	0.2		330	7.40	119	0.370	0.630	0.277	0.131
72/09/09	08 18	0000	15.6		42	305	8.80	108	0.070	0.080	0.092	0.028
	08 18	0005	15.6	9.3		300	8.83	109	0.060	0.080	0.124	0.026
72/10/19	15 10	0000			36	300	8.70	87	0.040	0.070	0.050	0.016
	15 10	0004	3.8	12.0		300	8.70	92	0.040	0.080	0.058	0.019
	15 10	0012	3.8	12.0		300	8.70	88	0.040	0.080	0.052	0.019

81

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/07/10	18 30	0000	24.3J
72/09/09	08 18	0000	13.7J
72/10/19	15 10	0000	37.9J

J- VALUE KNOWN TO BE IN ERROR

APPENDIX C

TRIBUTARY DATA

STORET RETRIEVAL DATE 74/10/30

2756A1 LS2756A1
47 29 30.0 092 36 00.0
UNNAMED TRIB FROM LK TO TWO RIVE
27 7.5 EVELETH
0/MASHKENODE LAKE
XING 3.5 MI NW OF EVELETH
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/15	16 45		0.024	0.892	0.081	0.007	0.070
72/11/12	10 15		0.042	0.840	0.087	0.022	0.075
73/04/18	18 20		0.014	0.900	0.021	0.006	0.075
73/05/02	18 30		0.012	0.780	0.011	0.007	0.075
73/05/19	11 45		0.010K	0.560	0.009	0.010	0.070
73/06/07	14 45		0.011	0.960	0.060	0.050	0.057
73/08/19	14 35		0.027		1.050	0.090	0.110
73/08/25	17 20		0.014	0.860	0.036	0.029	0.050
73/09/23	11 45		0.500	1.050	0.075	0.008	0.120

K VALUE KNOWN TO BE LESS
THAN INDICATED

STORET RETRIEVAL DATE 74/10/30

```
 275681          LS275681
47 30 30.0 092 34 30.0
UNNAMED TRIB TO LK FROM N SIDE
27      CO #69. SHEET #3
I/MASKENODE LAKE
CO HWY 103 XING ABOV NICHOLS STP
11EPALES                2111204
4                       0000 FEET  DEPTH
```

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/15	16 30		0.870	0.350	0.072	0.005K	0.020
72/11/12	10 45		0.460	0.720	0.130	0.005K	0.028
73/04/18	18 10		0.231	0.880	0.038	0.006	0.050
73/05/02	18 15		0.252	0.690	0.026	0.005K	0.040
73/05/19	14 00		0.380	0.480	0.035	0.008	0.015
73/06/07	14 35		0.800	0.640	0.069	0.022	0.050
73/08/19	14 40		1.500	0.270	0.034	0.011	0.025
73/08/25	17 10		1.220	0.375	0.042	0.006	0.020
73/09/23	12 15		1.160	0.540	0.088		0.075

K VALUE KNOWN TO BE LESS THAN INDICATED

STORET RETRIEVAL DATE 74/10/30

275651 TF275651 P012450
47 31 30.0 092 34 30.0
VIRGINIA
27 7.5 VIRGINIA
T/MASHKENODE
UNNAMED STREAM
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/01/31	11 00								
CP(T)-			10.000	14.000	0.140	4.175	4.700	2.060	2.160
73/01/31	13 00								
73/02/28	11 00								
CP(T)-			8.700	8.800	0.155	3.600	4.400	2.350	2.040
73/02/28	13 00								
73/03/31	11 00								
CP(T)-			9.400	6.900	0.540	3.500	4.200	2.700	2.480
73/03/31	13 00								
73/04/30	11 00								
CP(T)-			9.700	9.200	0.041	3.100	4.000	3.000	2.350
73/04/30	13 00								
73/05/29	11 00								
CP(T)-			10.000	7.200	0.350	3.500	4.500	2.540	2.740
73/05/29	13 00								
73/06/30	11 00								
CP(T)-			8.200	2.200	0.650	2.200	3.300	2.560	2.370
73/06/30	13 00								
73/07/31	11 00								
CP(T)-			9.200	2.400	1.030	3.100	3.500	2.680	2.590
73/07/31	13 00								
73/08/31	10 00								
CP(T)-				5.700		2.960	3.600	2.100	2.480
73/08/31	12 00								
73/09/30	11 00								
CP(T)-			7.800	2.200	0.360	3.900	4.300	2.120	2.280
73/09/30	13 00								
73/10/31	11 00								
CP(T)-			9.700	6.500	0.090	3.330	4.400	2.120	2.670
73/10/31	13 00								
73/11/30	11 00								
CP(T)-			8.400	6.150	0.190	4.400	6.250	2.370	2.300
73/11/30	13 00								
74/01/01	11 00								
CP(T)-			13.000	6.300	0.051	4.050	5.100	2.300	2.300
74/01/01	13 00								

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STORET RETRIEVAL DATE 74/10/30

275651 TF275651 P012450
47 31 30.0 092 34 30.0
VIRGINIA
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DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/01/31	11 00								
CP(T)-			10.100	4.500	0.180	4.600	7.600	2.240	2.740
74/01/31	13 00								

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